



- ☐ Tentative Specification
- ☒ Preliminary Specification
- ☐ Approval Specification

MODEL NO.: V370H4
SUFFIX: L01

Customer:

APPROVED BY

SIGNATURE

Name / Title _____

Note

Please return 1 copy for your confirmation with your signature and comments.

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**REVISION HISTORY**

Version	Date	Page (New)	Section	Description
Ver. 1.0	Aug. 02, 2010	All	All	The Preliminary Specification was first issued.
Ver. 1.1	Sep. 15, 2010	P.12	3.2.2	Power Consumption has been changed.
		P.12	3.2.1	Lamp specification
		P.28	7.2	Optical specifications

**1. GENERAL DESCRIPTION****1.1 OVERVIEW**

V370H4-L01 is a 37" TFT Liquid Crystal Display module with CCFL Backlight and 2ch-LVDS interface. This module supports 1920 x 1080 Full HDTV format and can display true 16.7M colors (8bit). The inverter module for backlight is built-in.

1.2 FEATURES

- High brightness (450 nits)
- High contrast ratio (6000:1)
- Fast response time (Gray to gray average 8.5 ms)
- High color saturation (NTSC 72%)
- Full HDTV (1920 x 1080 pixels) resolution, true HDTV format
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Ultra wide viewing angle : Super MVA technology
- RoHS compliance

1.3 APPLICATION

- Standard Living Room TVs.
- Public Display Application.
- Home Theater Application.
- MFM Application.

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	819.36 (H) x 460.89 (V) (37" diagonal)	mm	(1)
Bezel Opening Area	828.6(H) x 469.8 (V)	mm	
Driver Element	a-si TFT active matrix	-	
Pixel Number	1920 x R.G.B. x 1080	pixel	
Pixel Pitch (Sub Pixel)	0.14225 (H) x 0.42675 (V)	mm	
Pixel Arrangement	RGB vertical stripe	-	
Display Colors	16.7M	color	
Display Operation Mode	Transmissive mode / Normally Black	-	
Surface Treatment	Anti-Glare Coating (Haze 11%) Hard Coating (3H)	-	(2)

Note (1) Please refer to the attached drawings in chapter 9 for more information about the front and back outlines.

Note (2) The spec. of the surface treatment is temporarily for this phase. CMI reserves the rights to change this feature.

**1.5 MECHANICAL SPECIFICATION**

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	876.0	877.0	878.0	mm	(1)
	Vertical(V)	516.0	516.8	517.6	mm	
	Depth(D)	35.4	36.4	37.4	mm	To rear
	Depth(D)	52.0	53.0	54.0	mm	To inverter cover
Weight			7920		g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

**2. ABSOLUTE MAXIMUM RATINGS****2.1 ABSOLUTE RATINGS OF ENVIRONMENT**

Item	Symbol		Value		Unit	Note
			Min.	Max.		
Storage Temperature	TST		-20	+60	°C	(1)
Operating Ambient Temperature	TOP		0	50	°C	(1), (2)
Shock (Non-Operating)	SNOP	X,Y axis	-	50	G	(3), (5)
		Z axis	-	50	G	(3), (5)
Vibration (Non-Operating)	VNOP		-	1.0	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ($T_a \leq 40\text{ }^{\circ}\text{C}$).

(b) Wet-bulb temperature should be 39 °C Max. ($T_a > 40\text{ }^{\circ}\text{C}$).

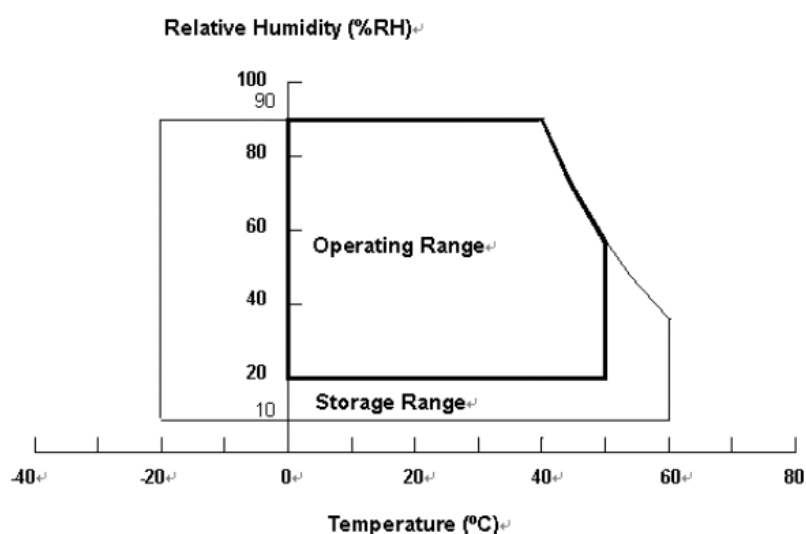
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for $\pm X$, $\pm Y$, $\pm Z$.

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



2.2 PACKAGE STORAGE

When storing modules as spares for a long time, the following precaution is necessary.

- (a) Do not leave the module in high temperature, and high humidity for a long time, It is highly recommended to store the module with temperature from 0 to 35 °C at normal humidity without condensation.
- (b) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

2.3 ELECTRICAL ABSOLUTE RATINGS**2.3.1 TFT LCD MODULE**

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	13.5	V	(1)
Logic Input Voltage	VIN	-0.3	3.6	V	

2.3.2 BACKLIGHT INVERTER UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	VW	—	3000	VRMS	
Power Supply Voltage	VBL	0	30	V	(1)
Control Signal Level	—	-0.3	7	V	(1), (3)

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) No moisture condensation or freezing.

Note (3) The control signals include On/Off Control and Internal PWM Control.

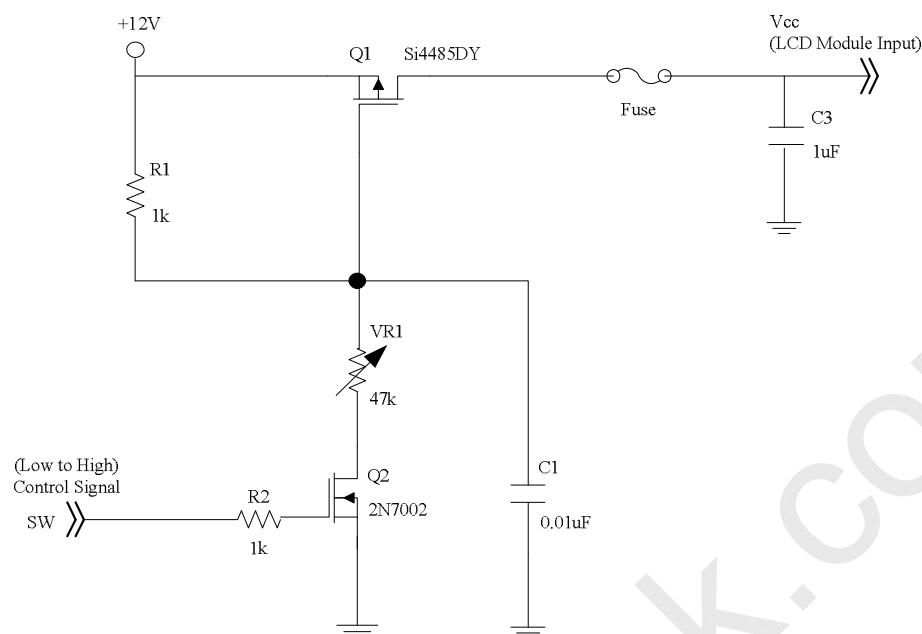
**3. ELECTRICAL CHARACTERISTICS****3.1 TFT LCD MODULE**

(Ta = 25 ± 2 °C)

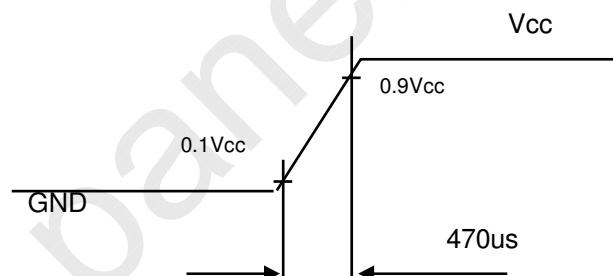
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V _{CC}	10.8	12	13.2	V	(1)
Rush Current		I _{RUSH}	-	-	2.8	A	(2)
Power Supply Current	White Pattern	-	-	0.32	-	A	(3)
	Horizontal Stripe	-	-	0.55	0.66	A	
	Black Pattern	-	-	0.31	-	A	
LVDS interface	Differential Input High Threshold Voltage	V _{LVTH}	+100	-	-	mV	(4)
	Differential Input Low Threshold Voltage	V _{LVTL}	-	-	-100	mV	
	Common Input Voltage	V _{CM}	1.0	1.2	1.4	V	
	Differential input voltage (Single-end)	V _{ID}	200	-	600	mV	
	Terminating Resistor	R _T	-	100	-	ohm	
CMOS interface	Input High Threshold Voltage	V _{IH}	2.7	-	3.3	V	
	Input Low Threshold Voltage	V _{IL}	0	-	0.7	V	

Note (1) The module should be always operated within the above ranges.

Note (2) Measurement condition:



Vcc rising time is 470us



Note (3) The specified power supply current is under the conditions at $V_{CC} = 12\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



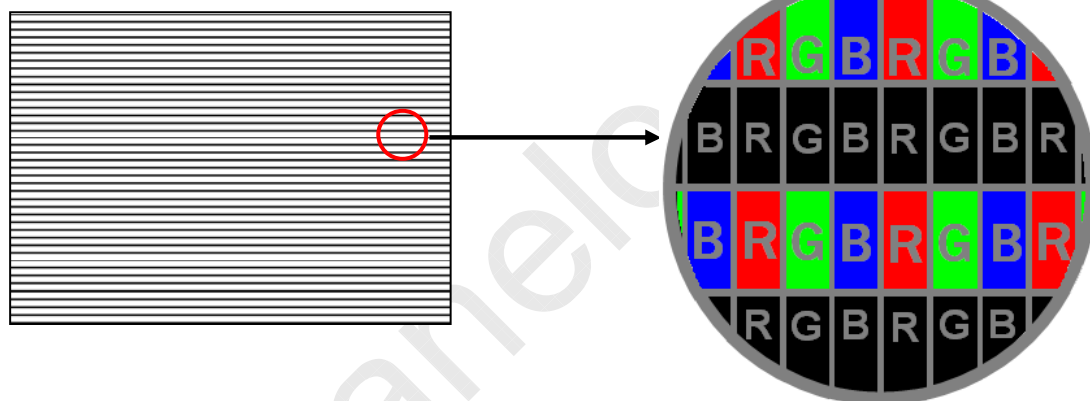
Active Area

b. Black Pattern

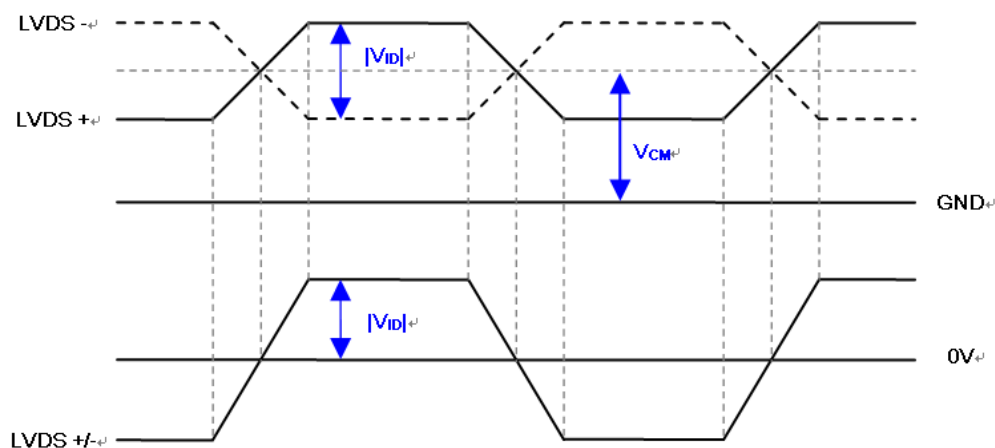


Active Area

c. Horizontal Pattern



Note (4) The LVDS input characteristics are as follows:



3.2 BACKLIGHT CONNECTOR PIN CONFIGURATION

3.2.1 LAMP SPECIFICATION

(Ta = 25 ± 2 °C)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V _W	-	(950)	-	V _{RMS}	
Lamp Current	I _L	3.0	(10.5)	(11.5)	mA _{RMS}	
Lamp Turn On Voltage	V _S	-	-	(1640)	V _{RMS}	(1) , Ta = 0 °C
		-	-	(1370)	V _{RMS}	(1) , Ta = 25 °C
Operating Frequency	F _O	30	-	80	KHz	-
Lamp Life Time	L _{BL}	50,000	-	-	Hrs	-

3.2.2 ELECTRICAL SPECIFICATION

(Ta = 25 ± 2 °C)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Total Power Consumption	P ₂₅₅	-	93	98	W	(5), (6), I _L = 10.5mA
Power Supply Voltage	V _{BL}	22.8	24	25.2	V _{DC}	
Power Supply Current	I _{BL}	-	3.88	4.08	A	Non Dimming
Input Inrush Current	-	-	-	6.03	A _{peak}	V _{BL} = 24V, (I _L = typ) (7)
Input Ripple Noise	-	-	-	912	mV _{P-P}	V _{BL} = 22.8V
Oscillating Frequency	F _W	50	53	56	kHz	(3)
Dimming frequency	F _B	150	160	170	Hz	
Minimum Duty Ratio	D _{MIN}	10	20	-	%	(8)

Note (1) Lamp current is measured by utilizing AC current probe and its value is average by measuring master and slave board.

Note (2) The lamp starting voltage V_S should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency of the display input signals, and it may result in line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point of lamp.) as the time in which it continues to operate under the condition at Ta = 25

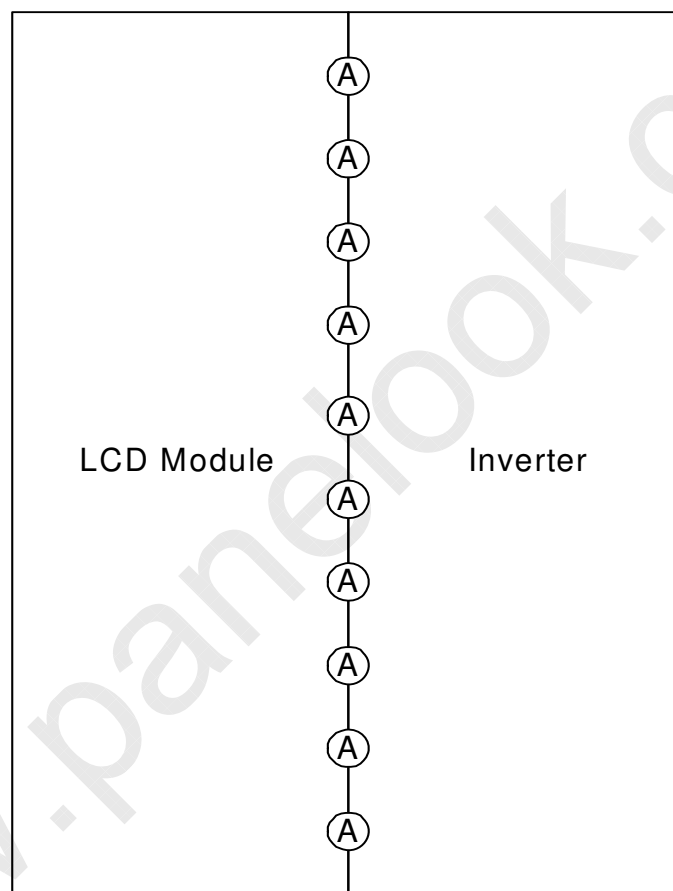
$\pm 2^{\circ}\text{C}$ and $I_L = 10.0 \sim 11.0\text{mA}_{\text{rms}}$.

Note (5) The power supply capacity should be higher than the total inverter power consumption P_{BL} . Since the pulse width modulation (PWM) mode was applied for backlight dimming, the driving current changed as PWM duty on and off. The transient response of power supply should be considered for the changing loading when inverter dimming.

Note (6) The measurement condition of Max. value is based on 37" backlight unit under input voltage 24V, average lamp current 10.8 mA and lighting 30 minutes later.

Note (7) The duration of Input Inrush Current is about VBL Rising Time 30ms.

Note (8) 10% minimum duty ratio is only valid for electrical operation



3.2.3 INVERTER INTERFACE CHARACTERISTICS

Parameter		Symbol	Test Condition	Value			Unit	Note
				Min.	Typ.	Max.		
On/Off Control Voltage	ON	V_{BLON}	—	2.0	—	5.0	V	
	OFF		—	0	—	0.8	V	
Internal PWM Control Voltage	MAX	V_{IPWM}	—	3.15	3.3	3.45	V	Maximum duty ratio
	MIN			—	0	—	V	Minimum duty ratio
External PWM Control Voltage	HI	V_{EPWM}	—	2.0	—	5.0	V	Duty on
	LO			0	—	0.8	V	Duty off
Status Signal	HI	Status	—	3.0	3.3	3.6	V	Normal
	LO			0	—	0.8	V	Abnormal
VBL Rising Time		$Tr1$	—	30	—	—	ms	10%-90% V_{BL}
Control Signal Rising Time		Tr	—	—	—	100	ms	
Control Signal Falling Time		Tf	—	—	—	100	ms	
PWM Signal Rising Time		T_{PWMR}	—	—	—	50	us	
PWM Signal Falling Time		T_{PWMF}	—	—	—	50	us	
Input impedance		R_{IN}	—	1	—	—	MΩ	
PWM Delay Time		T_{PWM}	—	100	—	—	ms	
BLON Delay Time	T_{on}	—	—	300	—	—	ms	
	T_{on1}	—	—	300	—	—	ms	
BLON Off Time		T_{off}	—	300	—	—	ms	

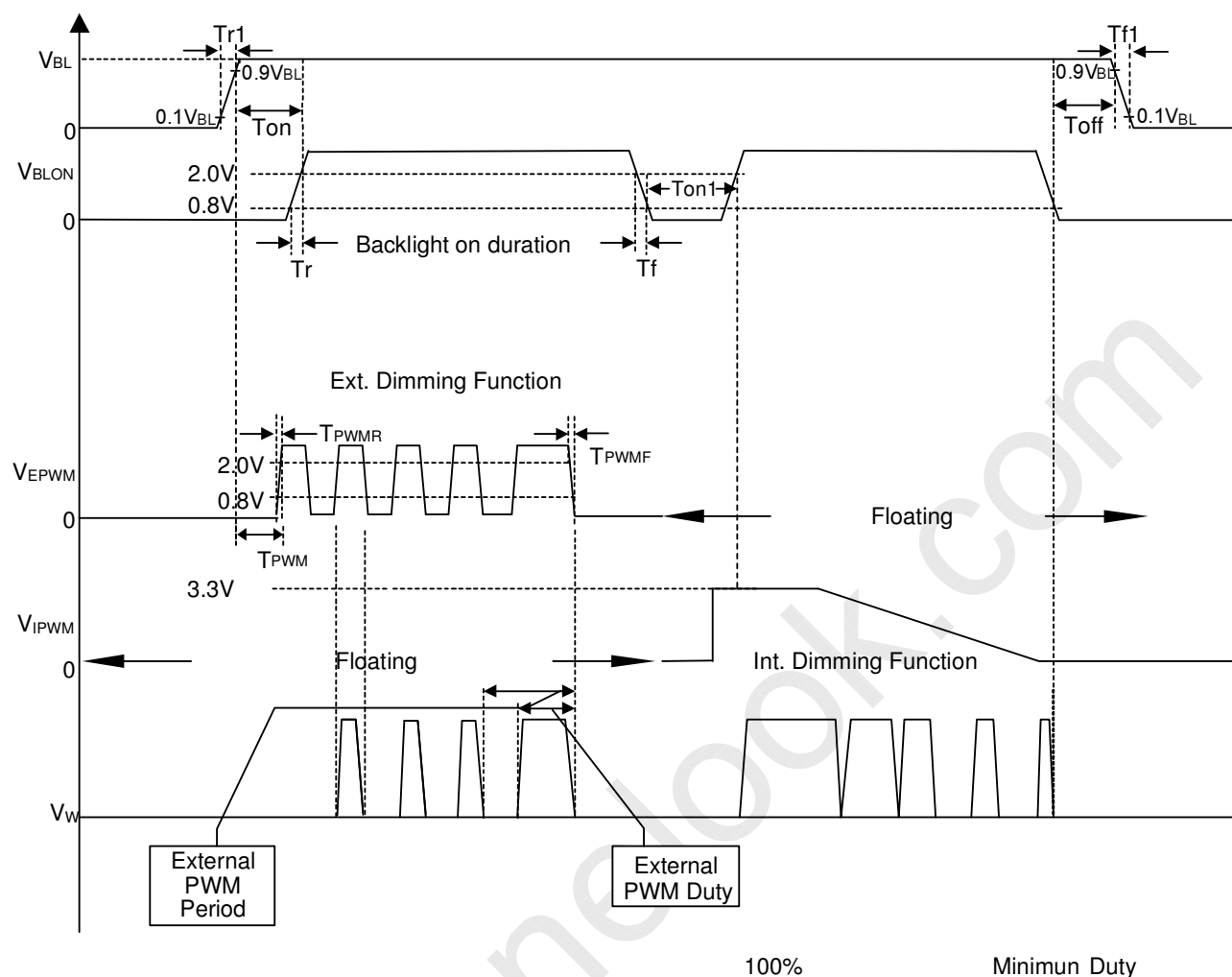
Note (1) The Dimming signal should be valid before backlight turns on by BLON signal. It is inhibited to change the internal/external PWM signal during backlight turn on period.

Note (2) The power sequence and control signal timing are shown in the following figure. For a certain reason, the inverter has a possibility to be damaged with wrong power sequence and control signal timing.

Note (3) While system is turned ON or OFF, the power sequences must follow as below descriptions:

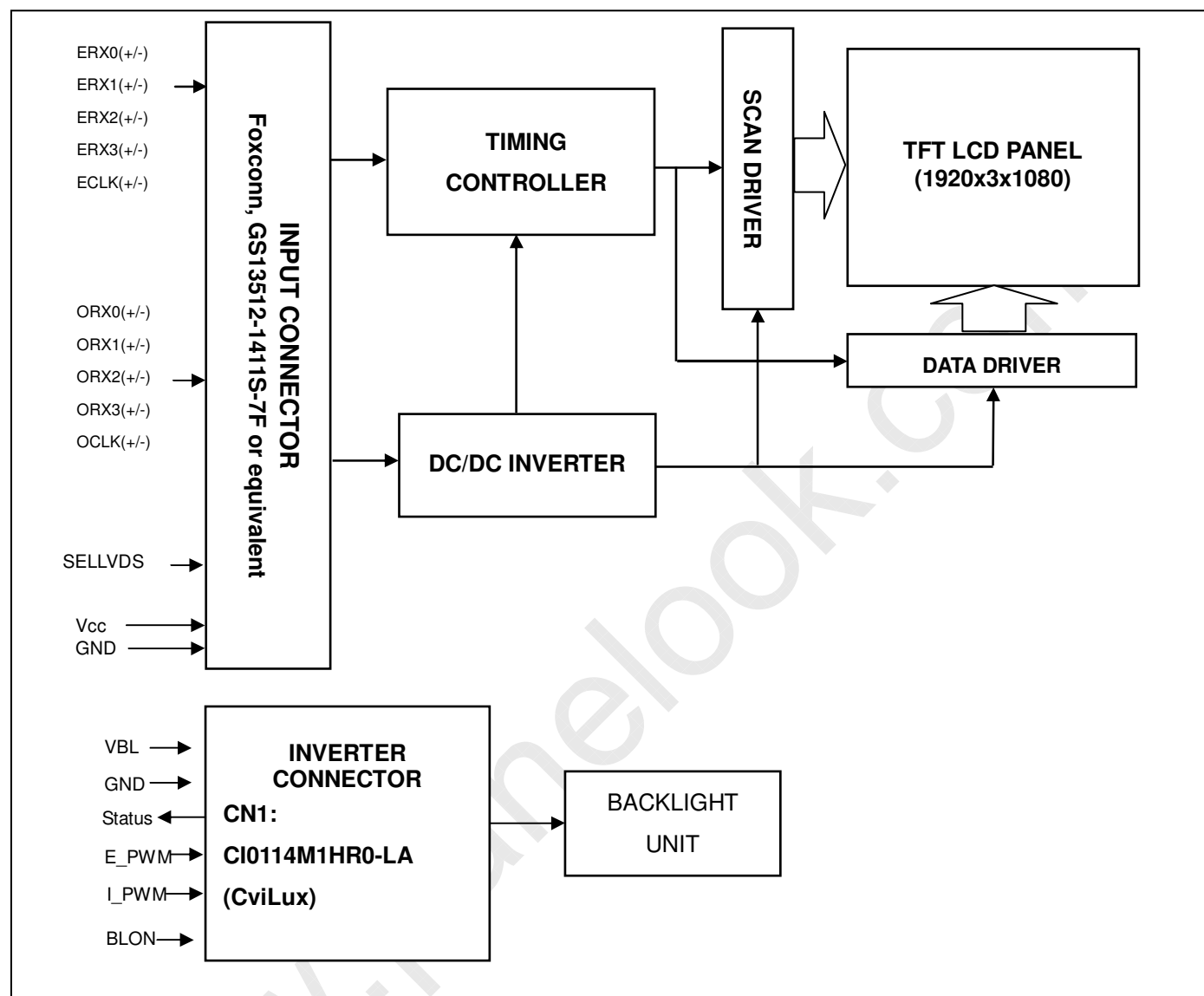
Turn ON sequence: VBL → PWM signal → BLON

Turn OFF sequence: BLOFF → PWM signal → VBL



4. BLOCK DIAGRAM OF INTERFACE

4.1 TFT LCD MODULE



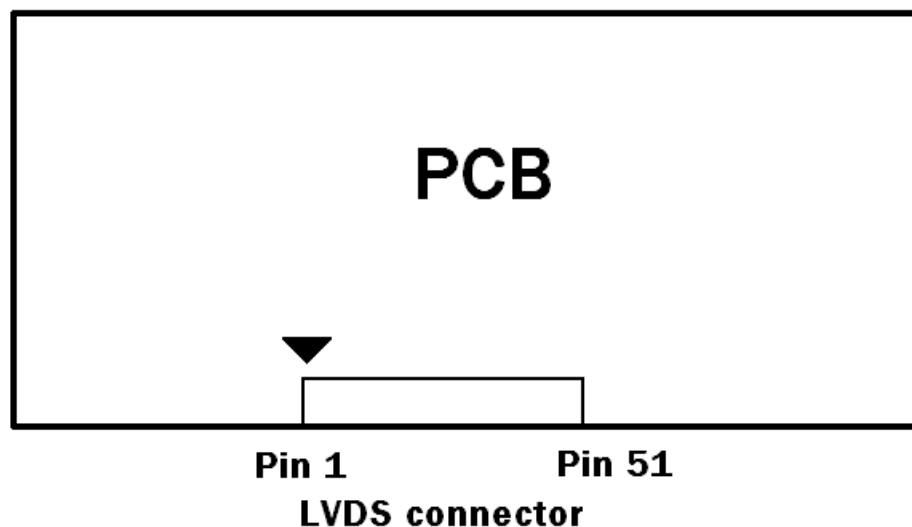


5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD Module Input CNF1 Connector Pin Assignment (GS13512-1411S-7F(Foxconn))

Pin	Name	Description	Note
1	GND	Ground	
2	N.C.	No Connection	
3	N.C.	No Connection	
4	N.C.	No Connection	(2)
5	N.C.	No Connection	
6	N.C.	No Connection	
7	SELLVDS	LVDS data format Selection	(3)(4)
8	N.C.	No Connection	
9	N.C.	No Connection	(2)
10	N.C.	No Connection	
11	GND	Ground	
12	ERX0-	Even pixel Negative LVDS differential data input. Channel 0	
13	ERX0+	Even pixel Positive LVDS differential data input. Channel 0	
14	ERX1-	Even pixel Negative LVDS differential data input. Channel 1	
15	ERX1+	Even pixel Positive LVDS differential data input. Channel 1	(5)
16	ERX2-	Even pixel Negative LVDS differential data input. Channel 2	
17	ERX2+	Even pixel Positive LVDS differential data input. Channel 2	
18	GND	Ground	
19	ECLK-	Even pixel Negative LVDS differential clock input	
20	ECLK+	Even pixel Positive LVDS differential clock input	(5)
21	GND	Ground	
22	ERX3-	Even pixel Negative LVDS differential data input. Channel 3	
23	ERX3+	Even pixel Positive LVDS differential data input. Channel 3	(5)
24	N.C.	No Connection	
25	N.C.	No Connection	(2)
26	GND	Ground	
27	GND	Ground	
28	ORX0-	Odd pixel Negative LVDS differential data input. Channel 0	
29	ORX0+	Odd pixel Positive LVDS differential data input. Channel 0	
30	ORX1-	Odd pixel Negative LVDS differential data input. Channel 1	
31	ORX1+	Odd pixel Positive LVDS differential data input. Channel 1	(5)
32	ORX2-	Odd pixel Negative LVDS differential data input. Channel 2	
33	ORX2+	Odd pixel Positive LVDS differential data input. Channel 2	
34	GND	Ground	
35	OCLK-	Odd pixel Negative LVDS differential clock input.	
36	OCLK+	Odd pixel Positive LVDS differential clock input.	(5)
37	GND	Ground	
38	ORX3-	Odd pixel Negative LVDS differential data input. Channel 3	
39	ORX3+	Odd pixel Positive LVDS differential data input. Channel 3	(5)
40	N.C.	No Connection	
41	N.C.	No Connection	(2)
42	GND	Ground	
43	GND	Ground	
44	GND	Ground	
45	GND	Ground	
46	GND	Ground	
47	N.C.	No Connection	(2)
48	VCC	+12V power supply	
49	VCC	+12V power supply	
50	VCC	+12V power supply	
51	VCC	+12V power supply	

Note (1) LVDS connector pin order defined as follows

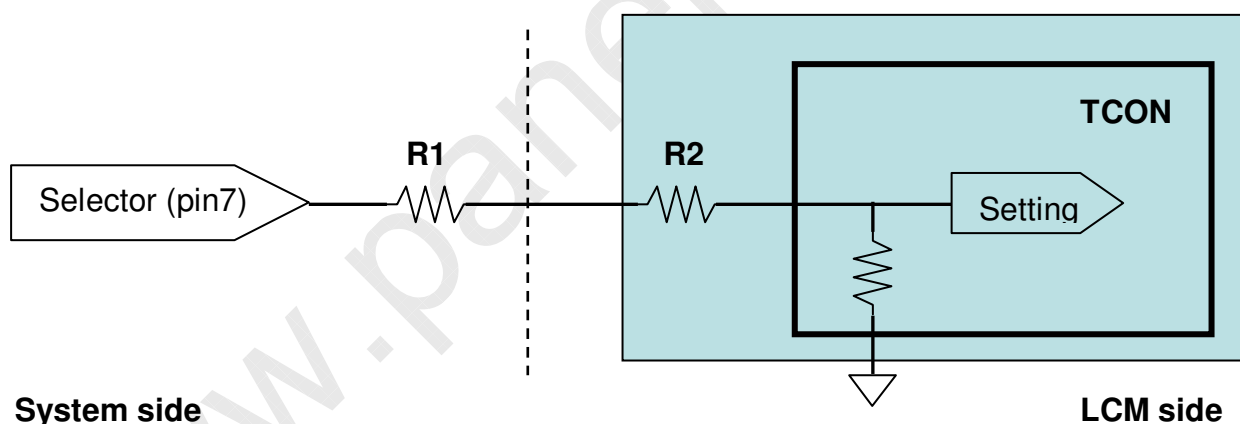


Note (2) Reserved for internal use. Please leave it open.

Note (3) Low = Open or connect to GND: VESA Format, High = Connect to +3.3V: JEIDA Format.

Note (4) LVDS signal pin connected to the LCM side has the following diagram.

R1 in the system side should be less than 1K Ohm. ($R1 < 1K \text{ Ohm}$)



System side: $R1 < 1K$

Note (5) Two pixel data send into the module for every clock cycle. The first pixel of the frame is odd pixel and the second pixel is even pixel.

**5.2 INVERTER UNIT**

CN1 (Header): CI0114M1HR0-LA (CviLux)

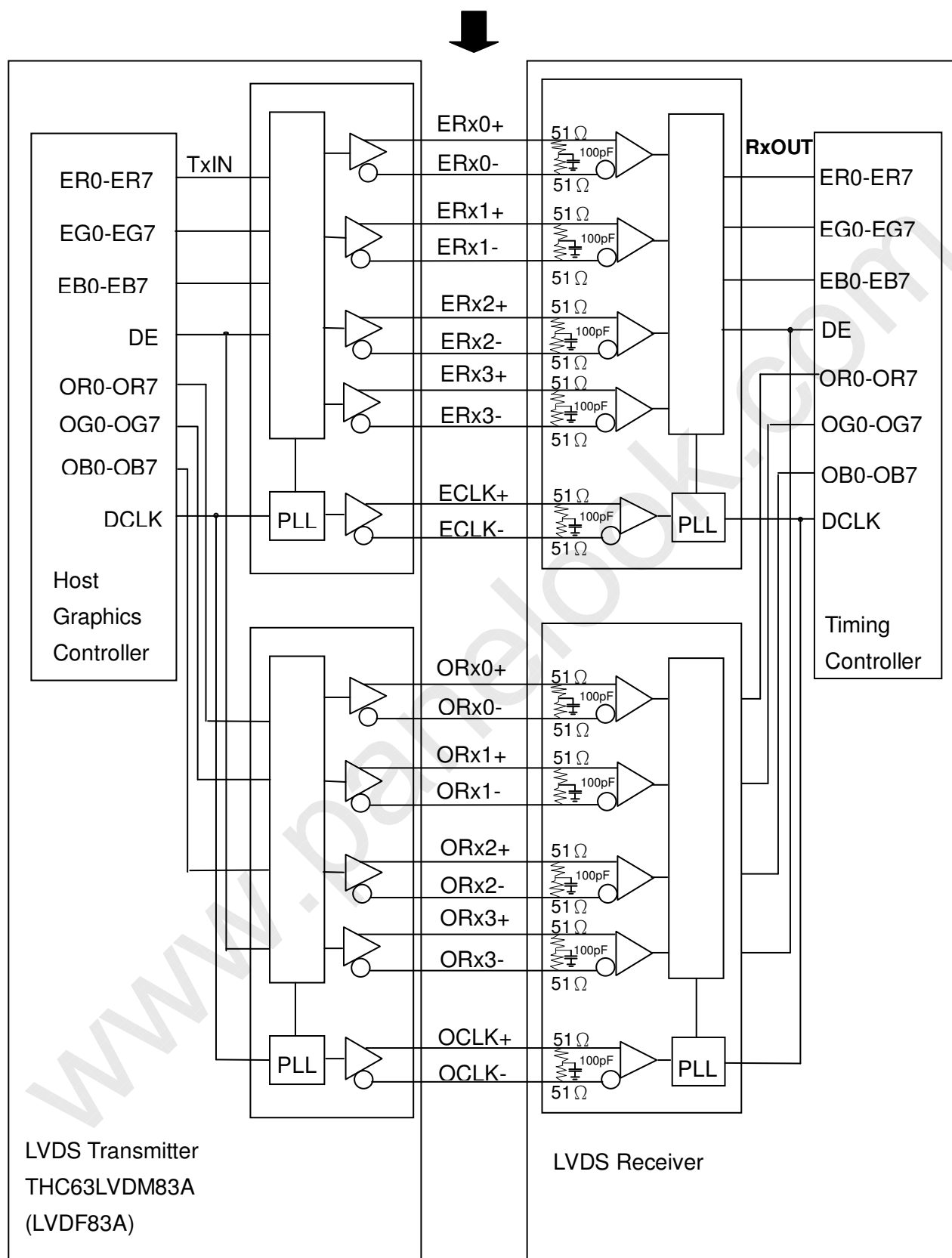
Pin No.	Symbol	Description
1	VBL	+24V Power input
2		
3		
4		
5		
6	GND	Ground
7		
8		
9		
10		
11	Status	Normal (3.3V) Abnormal (0V)
12	E_PWM	External PWM Control
13	I_PWM	Internal PWM Control
14	BLON	BL ON/OFF

Note (1) PIN 13: Internal PWM Control (Use Pin 13): Pin 12 must open.

Note (2) PIN 12: External PWM Control (Use Pin 12): Pin 13 must open.

Note (3) Pin 13(I_PWM) and Pin 12(E_PWM) can't open in same period.

5.3 BLOCK DIAGRAM OF INTERFACE



ER0~ER7: Even pixel R data

EG0~EG7: Even pixel G data

EB0~EB7: Even pixel B data

OR0~OR7: Odd pixel R data

OG0~OG7: Odd pixel G data

OB0~OB7: Odd pixel B data

DE: Data enable signal

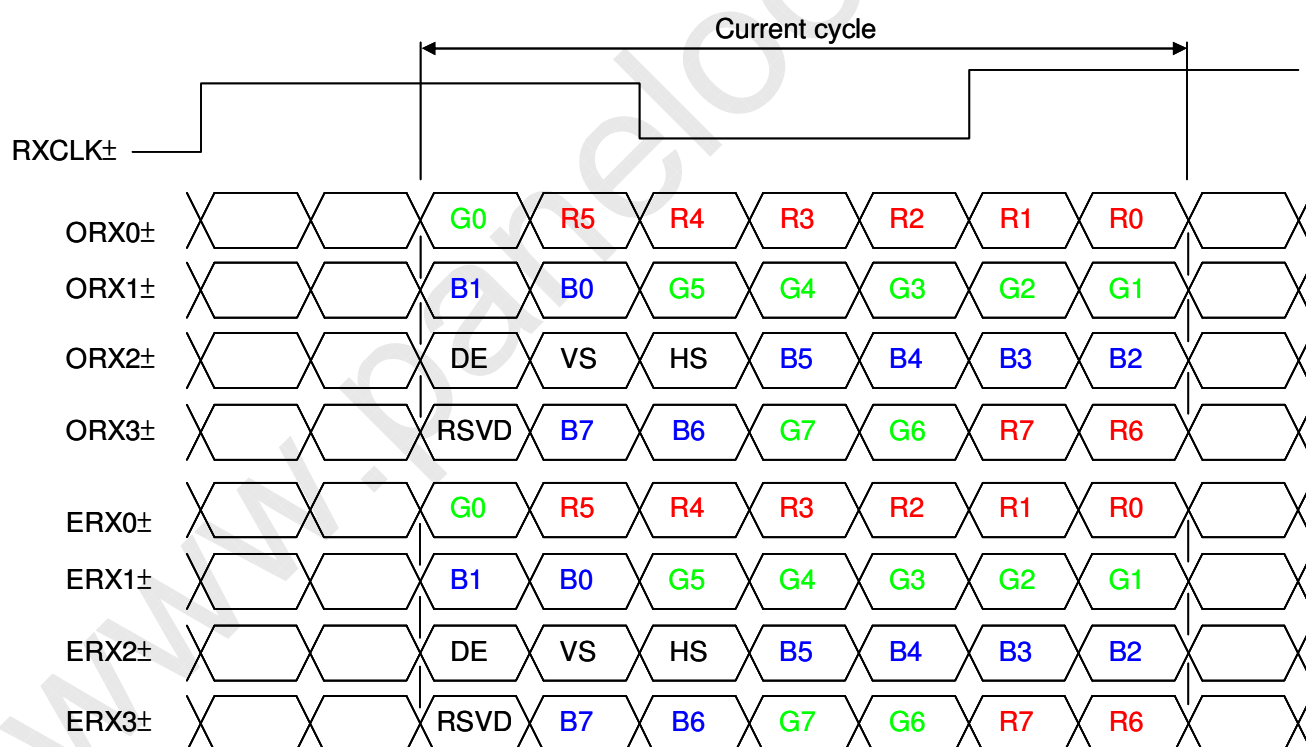
DCLK: Data clock signal

Notes (1) The system must have the transmitter to drive the module.

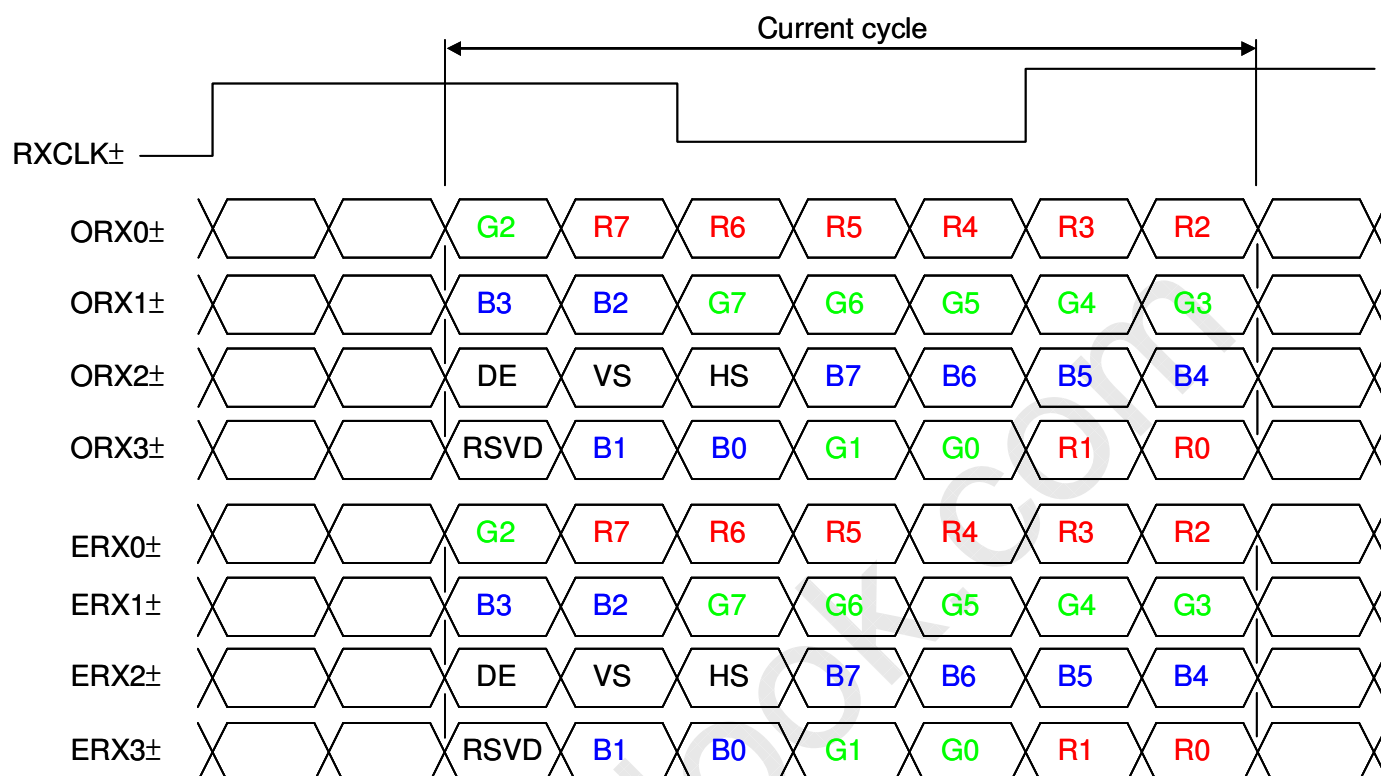
Notes (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially

5.4 LVDS INTERFACE

VESA LVDS format : (SELLVDS pin=L or open)



JEDIA LVDS format : (SELLVDS pin=H)



R0~R7: Pixel R Data (7; MSB, 0; LSB)

G0~G7: Pixel G Data (7; MSB, 0; LSB)

B0~B7: Pixel B Data (7; MSB, 0; LSB)

DE : Data enable signal

DCLK : Data clock signal

Notes: (1) RSVD (reserved) pins on the transmitter shall be "H" or "L".



5.5 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of the color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red (253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green (253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green (254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue (253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage



6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

(Ta = 25 ± 2 °C)

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	F_{clkin} (=1/TC)	60	74.25	80	MHz	
	Input cycle to cycle jitter	T_{rci}	—	—	200	ps	(3)
	Spread spectrum modulation range	F_{clkin_mod}	$F_{clkin}-2\%$	—	$F_{clkin}+2\%$	MHz	(4)
	Spread spectrum modulation frequency	F_{SSM}			200	KHz	
LVDS Receiver Data	Setup Time	T_{lvsu}	600	—	—	ps	(5)
	Hold Time	T_{lvhd}	600	—	—	ps	
Vertical Active Display Term	Frame Rate	F_{r5}	47	50	53	Hz	(6)
		F_{r6}	57	60	63	Hz	
	Total	T_v	1090	1125	1480	Th	$T_v=T_{vd}+T_{vb}$
	Display	T_{vd}	1080	1080	1080	Th	—
	Blank	T_{vb}	10	45	400	Th	—
Horizontal Active Display Term	Total	T_h	1030	1100	1325	Tc	$T_h=T_{hd}+T_{hb}$
	Display	T_{hd}	960	960	960	Tc	—
	Blank	T_{hb}	70	140	365	Tc	—

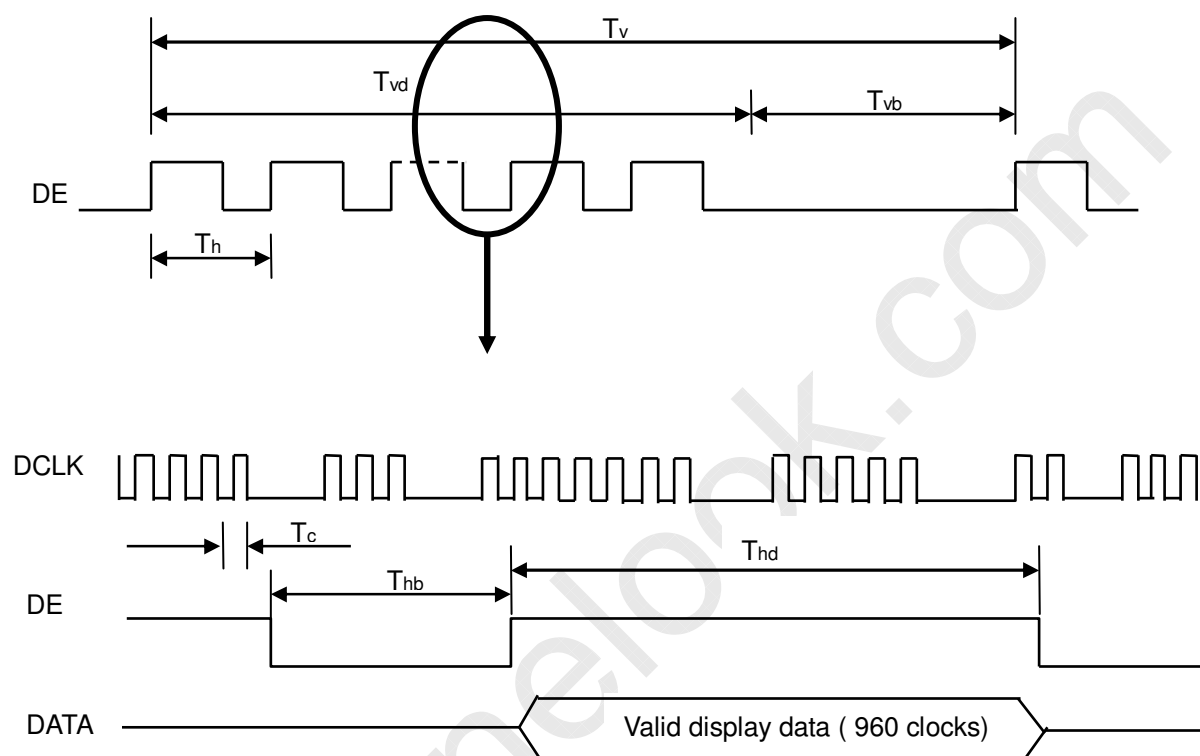
Note (1) Please make sure the range of pixel clock has follow the below equation :

$$F_{clkin}(\max) \geq F_{r6} \times T_v \times T_h$$

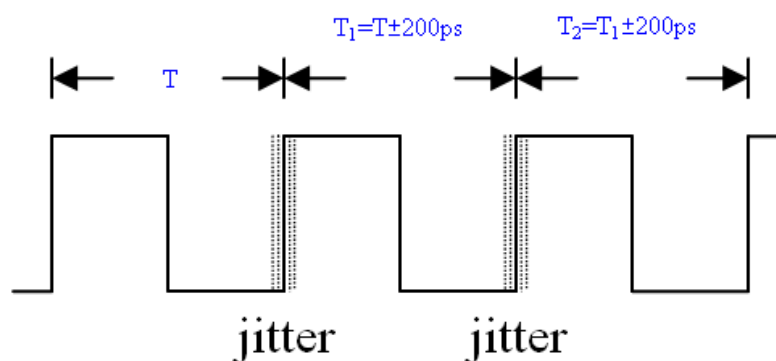
$$F_{r5} \times T_v \times T_h \geq F_{clkin}(\min)$$

Note (2) This module is operated in DE only mode and please follow the input signal timing diagram below :

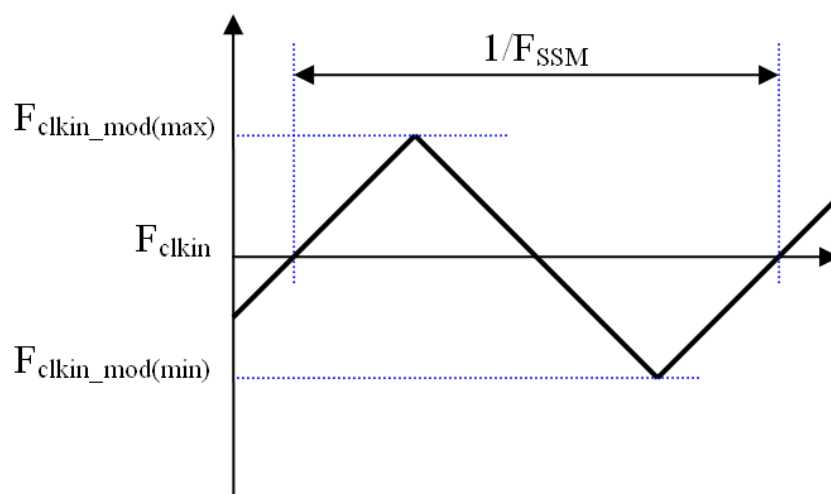
INPUT SIGNAL TIMING DIAGRAM



Note (3) The input clock cycle-to-cycle jitter is defined as below figures. $Trcl = |T_1 - T_1|$

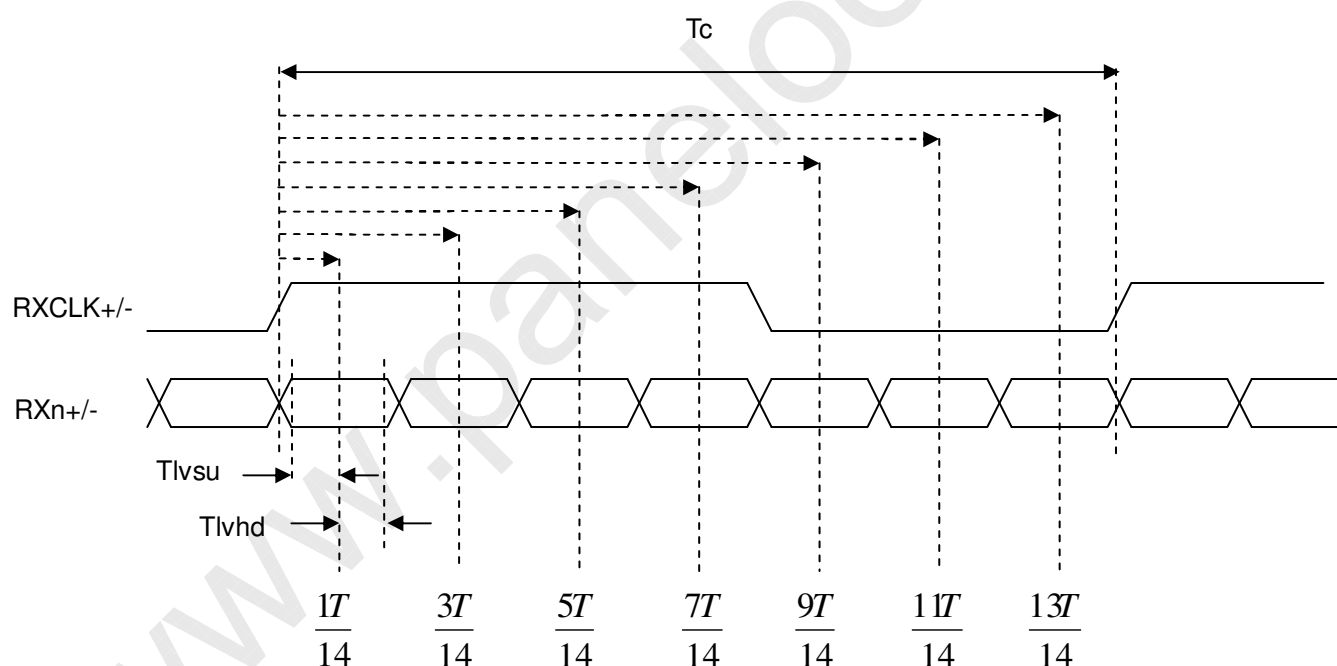


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (5) The LVDS timing diagram and setup/hold time is defined and showing as the following figures.

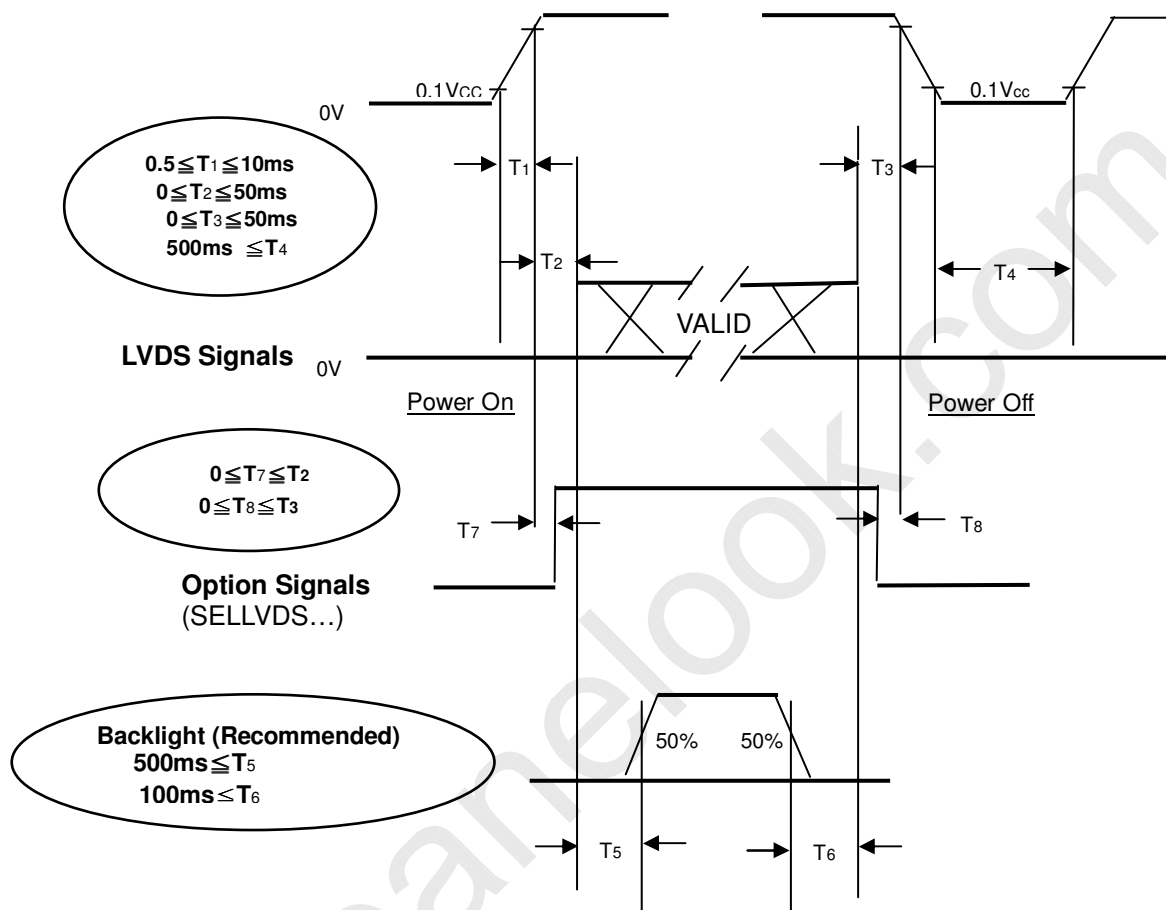
LVDS RECEIVER INTERFACE TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

($T_a = 25 \pm 2\text{ }^{\circ}\text{C}$)

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the diagram below.



Power ON/OFF Sequence

Note.

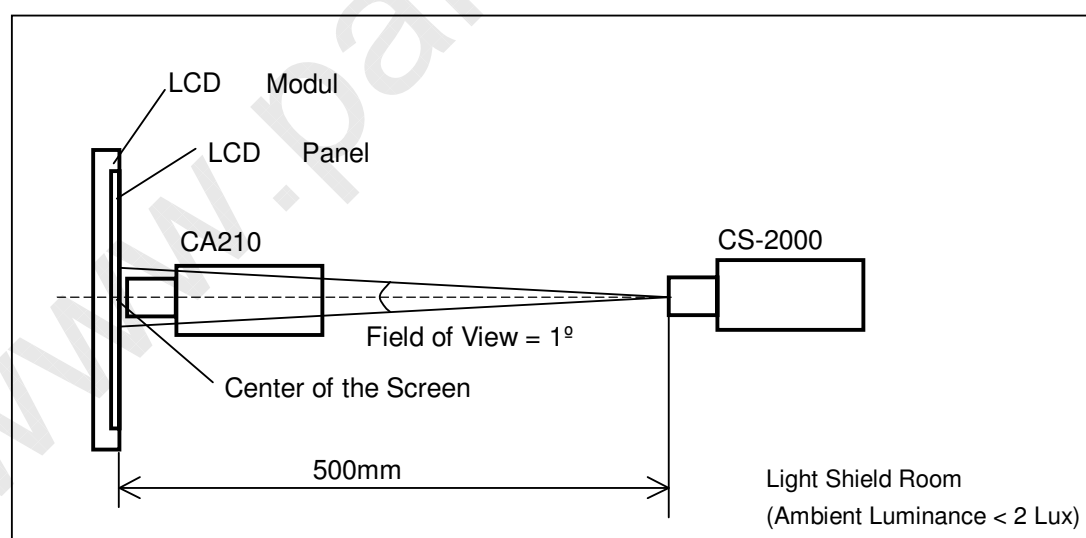
- (1) The supply voltage of the external system for the module input should follow the definition of V_{CC}.
- (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.
- (3) In case of V_{CC} is in off level, please keeping the level of input signals on the low or high impedance. If $T_2 < 0$, that maybe cause electrical overstress failures.
- (4) T₄ should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	oC
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	VCC	12	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current(HV)	I _L	(10.5± 0.5)	mA
Oscillating Frequency (Inverter)	F _w	53± 3	KHz
Frame rate		60	Hz

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 1 hour in a windless room.



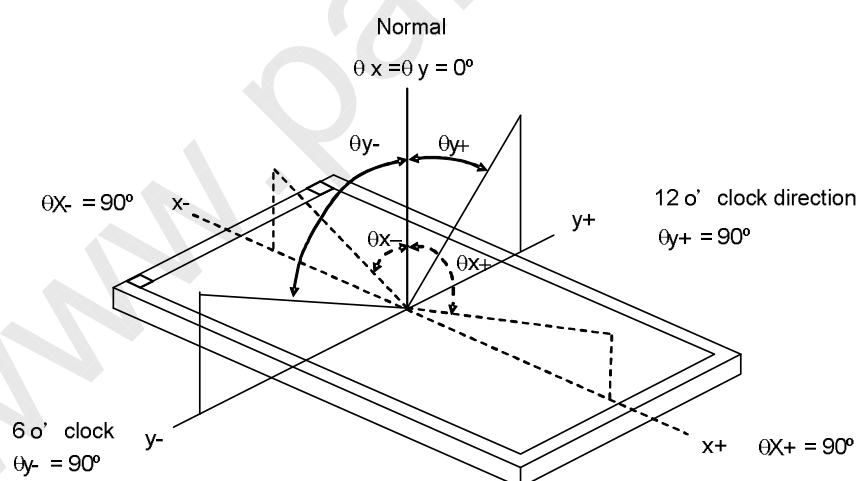
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in 7.1.

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note		
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing angle at normal direction	(4200)	(6000)	-	-	Note (2)		
Response Time		Gray to gray		-	(8.5)	-	ms	Note (3)		
Center Luminance of White		L _C		(360)	(450)	-	cd/m ²	Note (4)		
White Variation		δW		-	-	(1.3)	-	Note (7)		
Cross Talk		CT		-	-	4	%	Note (5)		
Color Chromaticity	Red	R _x		Typ.- 0.03	0.645	Typ.+ 0.03	-			
		R _y			0.326		-			
	Green	G _x			0.293		-			
		G _y			0.608		-			
	Blue	B _x			0.144		-			
		B _y	0.063		-					
	White	W _x	0.280		-					
		W _y	0.290		-					
	Color Gamut				(72)		-		%	NTSC
	Viewing Angle	Horizontal	θ _{x+}		CR≥20		80		88	-
θ _{x-}			80	88		-				
Vertical		θ _{y+}	80	88		-				
		θ _{y-}	80	88		-				

Note (1) Definition of Viewing Angle (θ_x, θ_y):

Viewing angles are measured by Autronic Conoscope Cono-80.



Note (2) Definition of Contrast Ratio (CR):

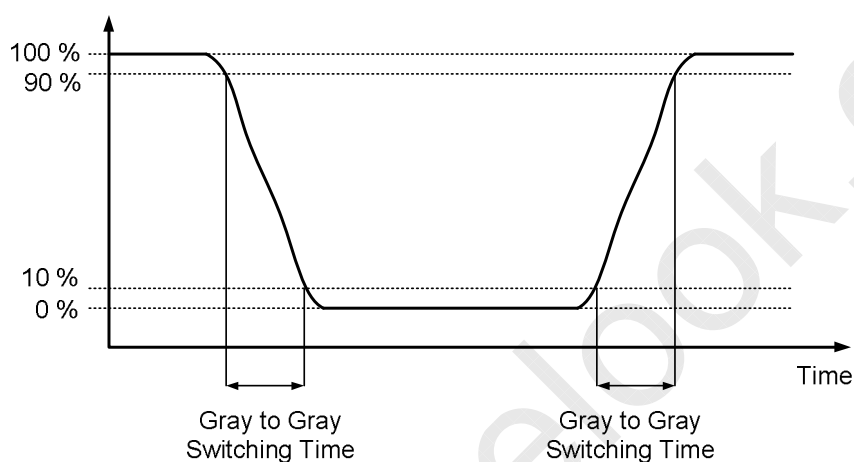
The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (6).

Note (3) Definition of Gray-to-Gray Switching Time:

Optical Response



The driving signal means the signal of gray level 0, 63, 127, 191, and 255. Gray to gray average time means the average switching time of gray level 0, 63, 127, 191, and 255. to each other.

Note (4) Definition of Luminance of White (LC):

Measure the luminance of gray level 255 at center point and 5 points

LC = L (5), where L (X) is corresponding to the luminance of the point X at the figure in Note (6).

Note (5) Definition of Cross Talk (CT):

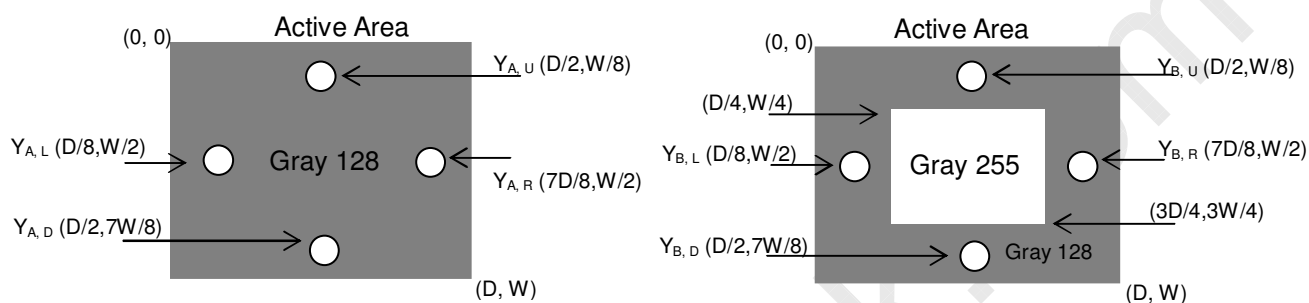
$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

(a)

Y_A = Luminance of measured location without gray level 255 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 255 pattern (cd/m^2)



(b)

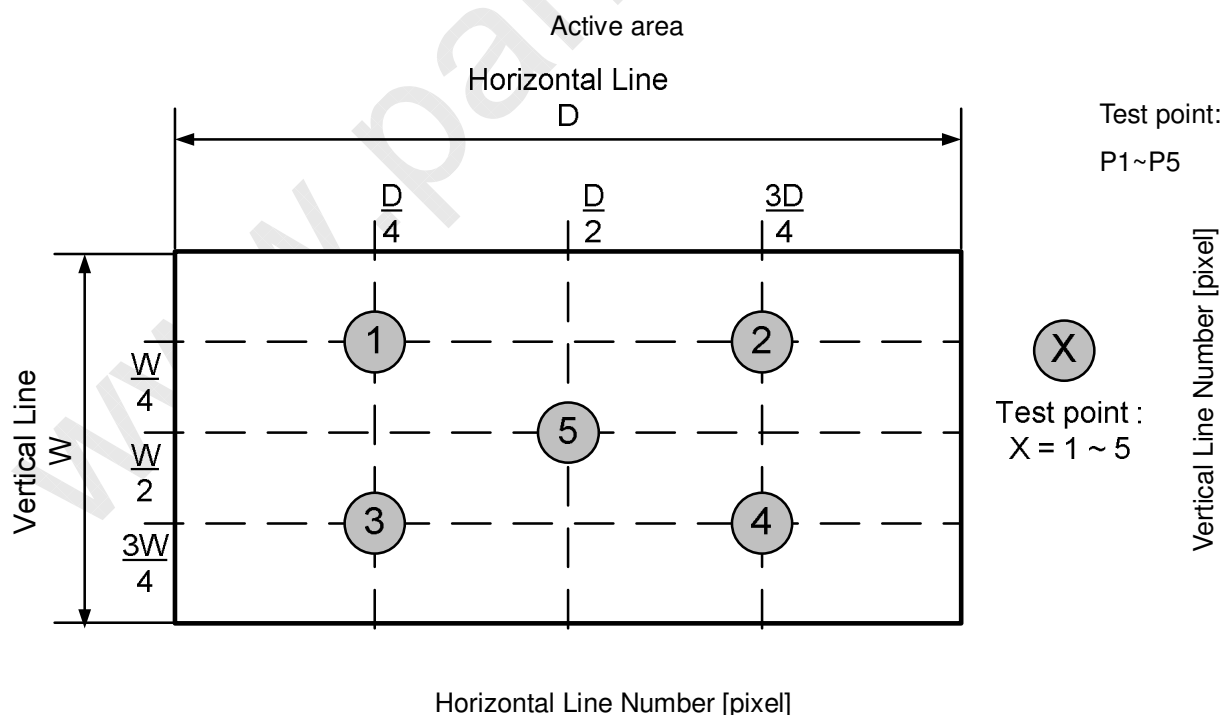
Y_A = Luminance of measured location without gray level 128 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 128 pattern (cd/m^2)

Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

$$\delta W = \text{Maximum} [L(1), L(2), \sim L(5)] / \text{Minimum} [L(1), L(2), \sim L(5)]$$



8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

- [1] Do not apply rough force such as bending or twisting to the module during assembly.
- [2] It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- [3] Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- [4] Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- [5] Do not plug in or pull out the I/F connector while the module is in operation.
- [6] Do not disassemble the module.
- [7] Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- [8] Moisture can easily penetrate into LCD module and may cause the damage during operation.
- [9] When storing modules as spares for a long time, the following precaution is necessary.
 - [9.1] Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35°C at normal humidity without condensation.
 - [9.2] The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.
- [10] When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

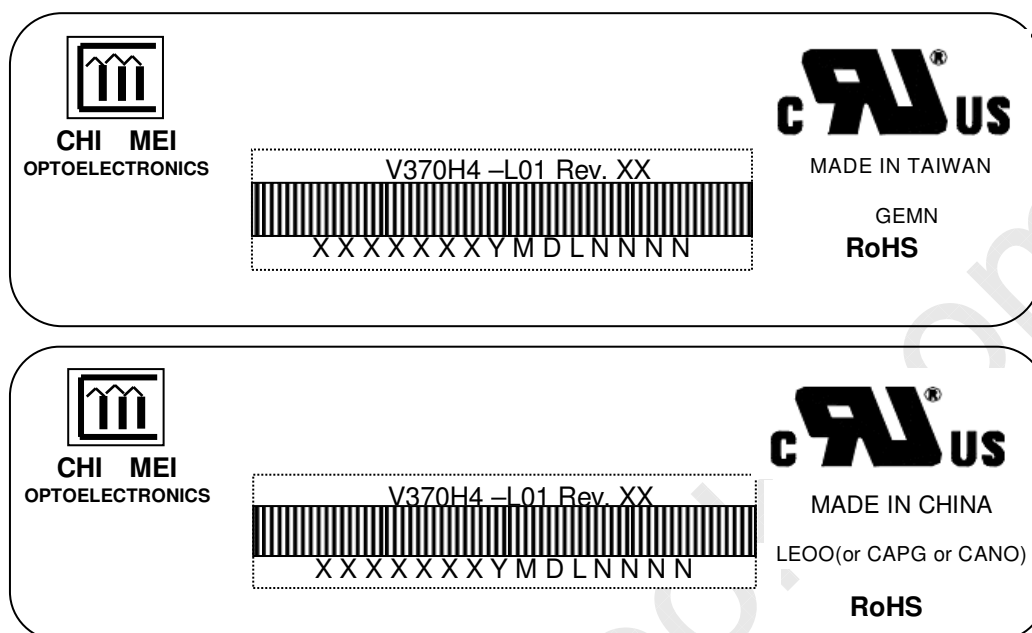
8.2 SAFETY PRECAUTIONS

- [1] The startup voltage of a Backlight is approximately 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the Backlight unit.
- [2] If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- [3] After the module's end of life, it is not harmful in case of normal operation and storage.

9. DEFINITION OF LABELS

9.1 CMI MODULE LABEL

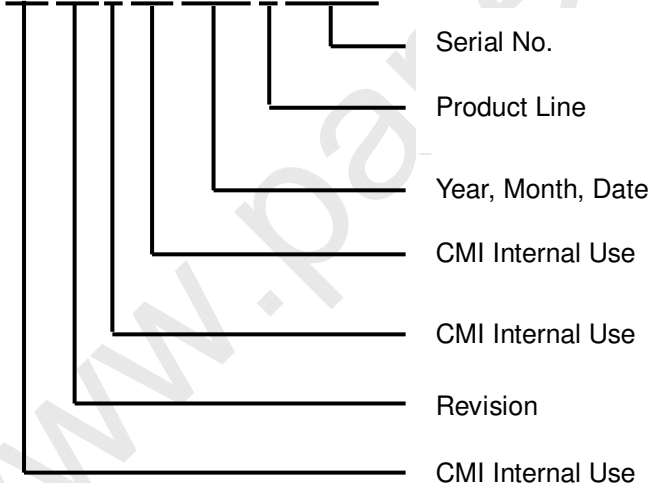
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



Model Name: V370H4-L01

Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.

Serial ID: X X X X X X Y M D L N N N N



Serial ID includes the information as below:

Manufactured Date:

Year: 2001=1, 2002=2, 2003=3, 2004=4... 2010=0, 2011=1, 2012=2..

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I, O, and U.

Revision Code: Cover all the change

Serial No.: Manufacturing sequence of product

Product Line: 1 -> Line1, 2 -> Line 2, ...etc.

10. PACKAGING**10.1 PACKING SPECIFICATIONS**

- (1) 5 LCD TV modules / 1 Box
- (2) Box dimensions : 954(L)x378(W)x602(H)mm
- (3) Weight : approximately 42.9 Kg (5 modules per box)

10.2 PACKING METHOD

Figures 10.1 and 10.2 are the packing method

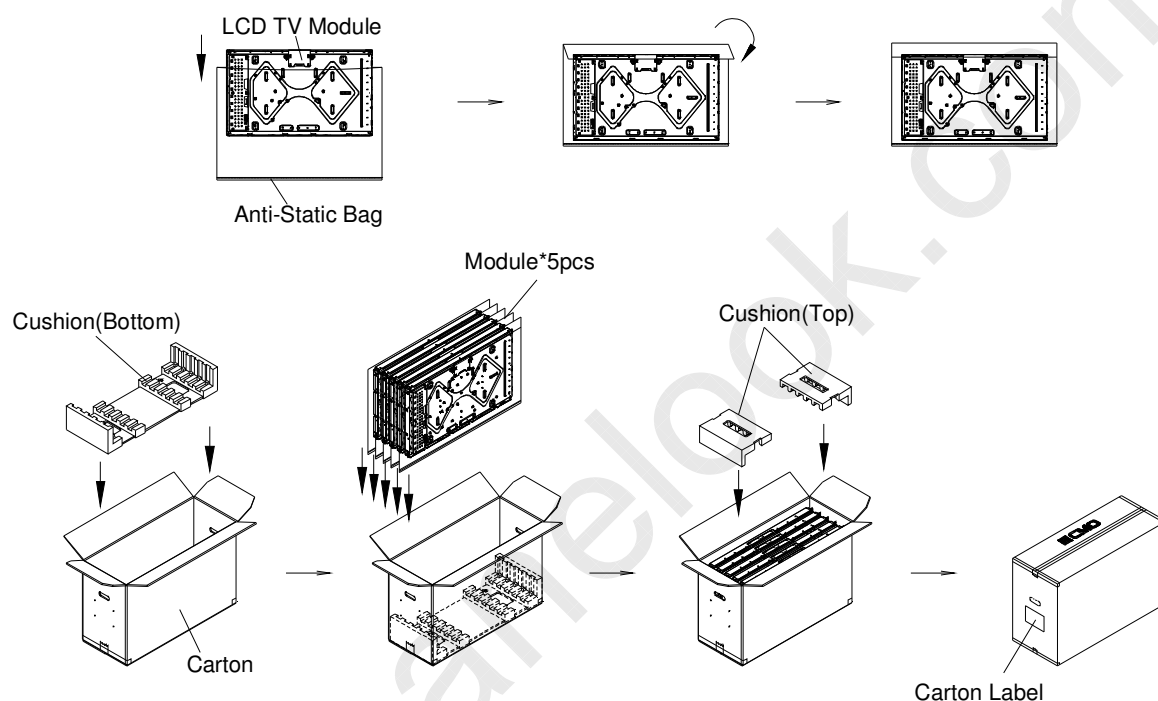
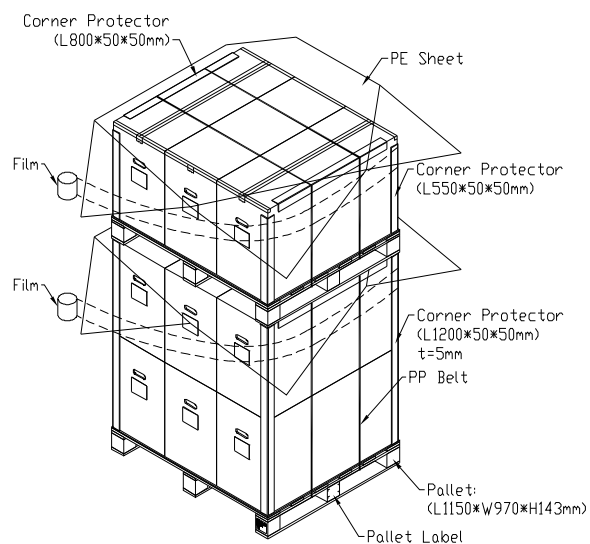


Figure.10.1 Packing method



Sea / Land Transportation (40ft Container)



Air Transportation

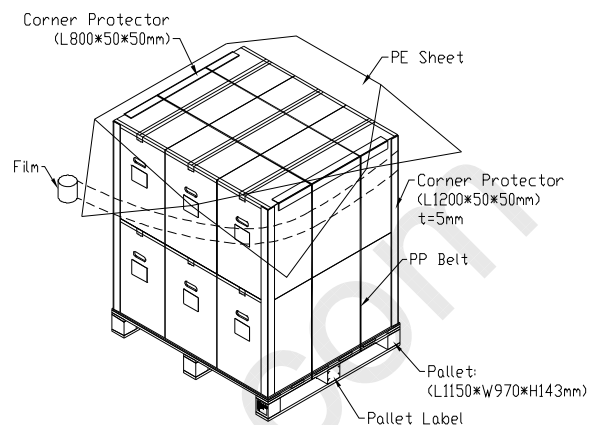
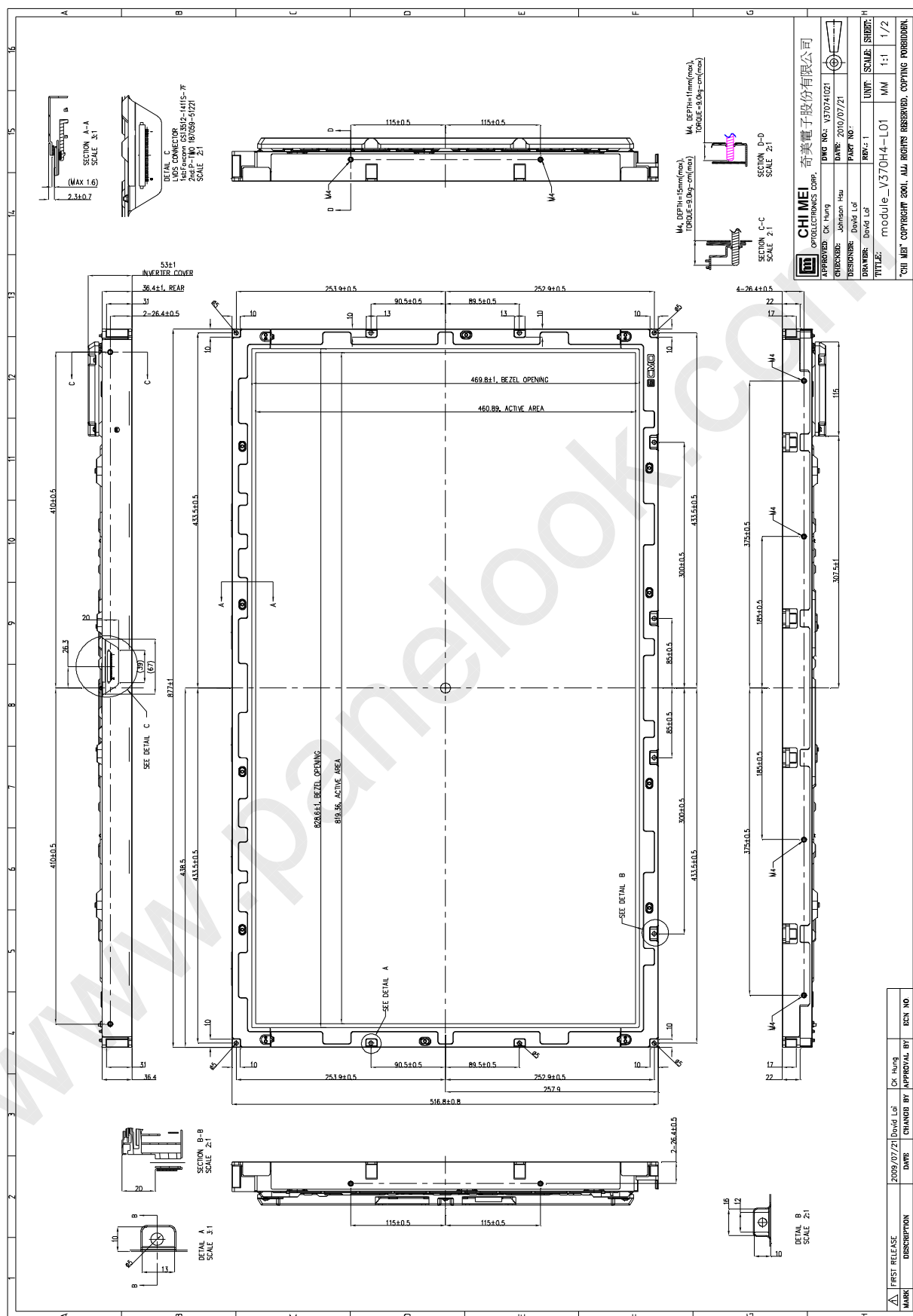


Figure.10.2 Packing method

11. MECHANICAL CHARACTERISTICS



PRODUCT SPECIFICATION

